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(54) **HIGH-SPEED INPUT/OUTPUT MODULE AND PLC APPARATUS.**

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## Description

### TECHNICAL FIELD

The present invention relates to a PLC device (programmable logic control device), and more specifically, to a PLC device provided with a high speed input/output module capable of processing an input/output signal at a high speed.

### BACKGROUND ART

A PLC device processes a sequence program by receiving an input signal and outputs an output signal as a result thereof, and repeatedly executes this cycle. A scanning time (process time) of the sequence program is usually about several milliseconds to one hundred milliseconds, and most controls are executed during that time, but some controls must be partially processed at a very high speed, e.g., in a very short time such as one millisecond or less.

Conventionally, a special unit is provided for the high speed processing, wherein a signal is transmitted between the special unit and a PLC device for effecting an overall control.

This special control unit, however, is cumbersome as a system and requires a large space for the installation. Further, in interface between the PLC device and the special unit is complex.

US-A-4117317, over which the present invention is characterised, discloses a digital controller with handwired backup connecting terminals.

JP-A-58186804 discloses a controller with some high speed handwired input/output circuits.

An object of the present invention is to solve the above problems and to provide a PLC device provided with a high speed input/output module capable of processing an input/output signal at a high speed without using a special high speed processing unit.

To solve the above problems, in accordance with the present invention, there is provided a high speed input/output module used for a PLC device or a numerical control apparatus, comprising:

a logical operation element which reads an external input signal and an output from the PLC device or the numerical control apparatus, and outputs a specific output pattern in accordance with the external input signal and the output, and inputs the specific output pattern to the PLC device or numerical control apparatus, the logical operation element comprising: an input circuit for receiving the external input signal; characterised by:

the logical operation element being programmable and further comprising:

a first latch, connected to the input circuit, for storing the external input signal;

a programmable device, connected to the first latch, for outputting the specific output pattern;

a second latch, connected to the programmable device, for storing the specific output pattern; and

an output circuit, connected to the second latch, for outputting the specific output pattern.

The logical operation element can independently execute a simple operation process, and processes an input/output which must be processed at a high speed, an externally outputs same. When necessary, the element later transmits it to a PLC control unit.

This high speed module is coupled with the PLC device, a numerical control apparatus or the like, and processes an external signal which must be processed at a high speed.

In addition, an arrangement of the PLC device including this high speed module processes the external signal which must be processed at a high speed, without the need for a special processing unit.

Fig. 1 is a block diagram of an overall PLC device of an embodiment of the present invention; and Fig. 2 is a detailed diagram of a high speed input/output module.

An embodiment of the present invention will be hereinafter described in detail with reference to the drawings.

FIG. 1 is a block diagram of an overall PLC device of an embodiment of the present invention, wherein 10 designates a PLC control unit as a center for controlling the PLC device; 20 designates a high speed input/output module for processing an input/output signal to be processed at a high speed, which will be described later in detail; 41 designates an input module for receiving an input signal from a switch or the like and applies the input signal to the PLC control unit through an I/O bus; and 42 designates an output module for receiving an output signal from the PLC control unit 10 through the I/O bus 40, and outputs same to energize a lamp, a solenoid and the like.

Next, the interior of the PLC control unit 10 will be described. Designated at 11 is a microprocessor for controlling the overall PLC device; designated at 12 is a ROM in which a system program is stored, the microprocessor 11 controlling the PLC device in accordance with the system program in the ROM 12; designated at 13 is a RAM for a workpiece in which data and the like is stored; and designated at 14 is a RAM in which a sequence program and the like for a sequence processing is stored. The sequence program is used for regulating the operation of a machine which is actually controlled by the PLC device, and can be changed in midcourse in accordance with a change in the operation of the machine. The RAM 14 is backed up by a battery 15 to maintain the sequence program when a power supply is turned off.

A usual signal, which need not be processed at a high speed, is received from the input module 41, processed in accordance with the sequence program, and output from the output module 42. A signal to be

processed at a high speed is input to the high speed input/output module 20, processed in the interior thereof, and output from the high speed input and output module 20. If necessary, a result of the output is later transmitted to the PLC control unit 10. For example, the signal to be processed at a high speed is a signal to be output in correspondence with a signal received from an external absolute encoder mounted on a shaft rotating at a high speed.

Next, the high speed input/output module 20 will be described in detail. FIG. 2 is a detailed diagram of the high speed input/output module 20, wherein 21 designates a buffer as an interface with the I/O bus 40; 22 designates a bus buffer for applying an input signal and the like to the I/O bus 40 through the bus buffer 21; 23 designates a latch for temporarily storing a signal from the PLC control unit 10; 24 designates a latch for storing an input signal and a signal from the latch 23 in synchronism with a clock of a clock circuit 25; 26 designates an EPROM programmed to output a specific output pattern to a certain input to thereby execute a logic operation; 27 designates a latch for storing an output from the EPROM 26 in synchronism with a clock of the clock circuit 25; 28 designates an input circuit comprising a receiver; and 29 designates an output circuit comprising a driver.

Next, the operation of the high speed input/output module 20 will be described. When a signal to be processed at a high speed is received by the input circuit 28, the signal is applied to the EPROM 26 through the latch 24, and thus a logical operation predetermined by a program is executed. For example, the EPROM 26 receives a signal from the absolute encoder mounted on the shaft rotating at a high speed, as described above, and outputs a pattern signal corresponding to that signal. The output signal from the EPROM 26 is stored in the latch 27 and externally output from the output circuit 29 for controlling an external apparatus at a high speed. If the output signal is required by the PLC control unit 10, it is transmitted thereto through the bus buffers 22 and 21.

A signal which need not be processed at a high speed is received by the input circuit 28 and transmitted to the PLC control unit 10 as it is, through the bus buffers 22, 21. Conversely, the usual output is externally output from the output circuit 29 through the bus buffer 21 and the latch 23.

Although the high speed logical operation element is described as an EPROM in the above description, a PLD (programmable logic device) or the like, for example, may be used instead of the EPROM.

A RAM also may be used instead of the EPROM, and when a RAM is used, a greater flexibility can be provided because a logical operation to be processed at a high speed, an input signal, and the like can be rewritten in response to a command from the PLC control unit 10.

According to the present invention, as described

above, since a high speed input/output module is provided which includes a logical operation element capable of processing an input/output signal at a high speed, the high speed input/output module can be coupled with a PLC device or the like, instead of a special high speed processing unit, to process an external signal at a high speed.

In addition, since the PLC device includes the high speed input/output module provided with the logical operation element capable of processing an input/output signal at a high speed, an external signal to be processed at a high speed can be processed without using a special high speed processing unit.

### Claims

1. A high speed input/output module (20) used for a programmable logic control device, called a PLC device, or a numerical control apparatus, comprising:

a logical operation element (20) which reads an external input signal and an output from the PLC device or the numerical control apparatus, and outputs a specific output pattern in accordance with the external input signal and the output, and inputs the specific output pattern to the PLC device or numerical control apparatus, the logical operation element (20) comprising: an input circuit (28) for receiving the external input signal; characterised by:

the logical operation element being programmable and further comprising:

a first latch (24), connected to the input circuit, for storing the external input signal;

a programmable device (26), connected to the first latch, for outputting the specific output pattern ;

a second latch (27), connected to the programmable device, for storing the specific output pattern; and

an output circuit (29), connected to the second latch, for outputting the specific output pattern.

2. A high speed input/output module (20) according to claim 1, wherein the programmable device is in EPROM.

3. A high speed input/output module (20) according to claim 1, wherein the programmable device is a programmable logic device, called a PLD.

4. A high speed input/output module (20) according to claim 1, wherein the programmable device is an RAM.

5. A PLC device executing a logical operation proc-

ess of a sequence program by a microprocessor, characterised by including a high-speed input/output module (20) according to any of claims 1 to 4 and further comprising:

at least one input module (41), connected to the PLC for receiving signals which must not be executed at high speed; and

at least one output module (42), connected to the PLC for outputting signals at low speed from the programmable logic control means.

## Patentansprüche

1. Schnelles Input/Output-Modul (20) für eine programmierbare logische Steuerung, genannt PLC, oder für eine numerische Steuerung bestehend aus:

einem logischen operationselement (20), das ein externes Inputsignal und ein Outputsignal der PLC oder der numerischen Steuerung liest, und ein spezifisches Output-Signalmuster gemäß dem externen Inputsignal und Outputsignal abgibt, und das spezifische Outputsignalmuster der PLC oder der numerischen Steuerung eingibt, und das eine Inputschaltung (28) aufweist, das das externe Inputsignal erhält, gekennzeichnet durch:

das logische Operationselement ist programmierbar und weist ferner auf:

einen ersten an die Inputschaltung angeschlossenen Speicher (24) zum Speichern des externen Inputsignals;

eine an den ersten Speicher angeschlossenen programmierbaren Einrichtung (26) zum Abgeben des spezifischen Outputsignalmusters;

einem an die programmierbare Einrichtung angeschlossenen zweiten Speicher (27) des Speichern des spezifischen Outputsignalmusters und

einer an den zweiten Speicher angeschlossenen Outputschaltung (29) zum Abgeben des spezifischen Outputsignalmusters.

2. Schnelles Input/Output-Modul (20) nach Anspruch 1, bei dem die programmierbare Einrichtung ein EPROM ist.

3. Schnelles Input/Output-Modul (20) nach Anspruch 1, bei dem die programmierbare Einrichtung eine programmierbare logische Einrichtung, genannt PLD, ist.

4. Schnelles Input/Output-Modul (20) nach Anspruch 1, bei dem die programmierbare Einrichtung ein RAM ist.

5. Eine PLC-Steuerung zum Ausführen eines logi-

schen Operationsprozesses eines Abfolgeprogramms durch einen Mikroprozessor, gekennzeichnet durch ein schnelles Input/Output-Modul (20) nach einem der Ansprüche 1 bis 4 und ferner bestehend aus:

mindestens einem an die PLC angeschlossenen Input-Modul (41) zum Empfangen von Signalen, die nicht schnell verarbeitet werden müssen und mindestens einem an die PLC angeschlossene Output-Modul (42) zum Abgeben von langsamen Signalen aus der programmierbaren logischen Steuerung.

## Revendications

1. Un module d'entrée/sortie rapide (20) utilisé pour un dispositif à commande logique programmable, appelé dispositif PLC, ou pour un appareil à commande numérique, comprenant :

un élément à fonctionnement logique (20) qui lit un signal d'entrée externe et un signal de sortie du dispositif PLC ou de l'appareil à commande numérique, et délivre un motif de sortie spécifique en accord avec le signal d'entrée externe et le signal de sortie, et envoie le motif de sortie spécifique vers le dispositif PLC ou vers l'appareil à commande numérique, l'élément à fonctionnement logique (20) comprenant : un circuit d'entrée (28) pour recevoir le signal d'entrée externe ; caractérisé en ce que :

l'élément à fonctionnement logique est programmable et comprend en outre :

un premier verrou (24), relié au circuit d'entrée, pour mémoriser le signal d'entrée externe ;

un dispositif programmable (26), relié au premier verrou, pour délivrer le motif de sortie spécifique ;

un second verrou (27), relié au dispositif programmable, pour mémoriser le motif de sortie spécifique ; et

un circuit de sortie (29), relié au second verrou, pour délivrer le motif de sortie spécifique.

2. Un module d'entrée/sortie rapide (20) selon la revendication 1, dans lequel le dispositif programmable est une EPROM.

3. Un module d'entrée/sortie rapide (20) selon la revendication 1, dans lequel le dispositif programmable est un dispositif logique programmable appelé un PLD.

4. Un module d'entrée/sortie rapide (20) selon la revendication 1, dans lequel le dispositif programmable est une RAM.

5. Un dispositif PLC faisant effectuer un processus

d'opération logique d'un programme séquentiel  
par un microprocesseur, caractérisé en ce qu'il  
comprend un module d'entrée/sortie rapide (20)  
selon une quelconque des revendications 1 à 4,  
et en ce qu'il comprend en outre : 5  
au moins un module d'entrée (41), relié au PLC  
pour recevoir des signaux qui ne doivent pas être  
exécutés rapidement ; et  
au moins un module de sortie (42), relié au PLC 10  
pour délivrer des signaux lents à partir des  
moyens de commande à logique programmable.

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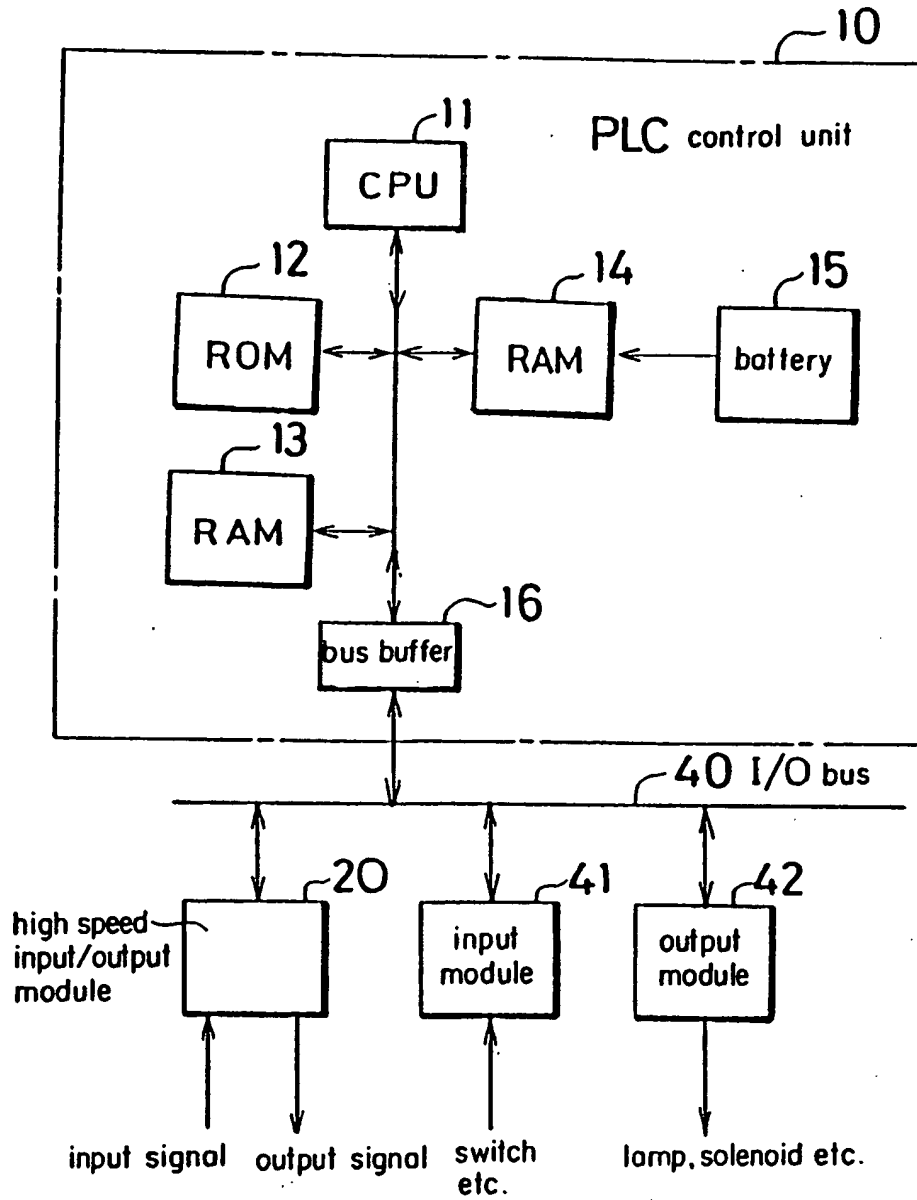


Fig. 1

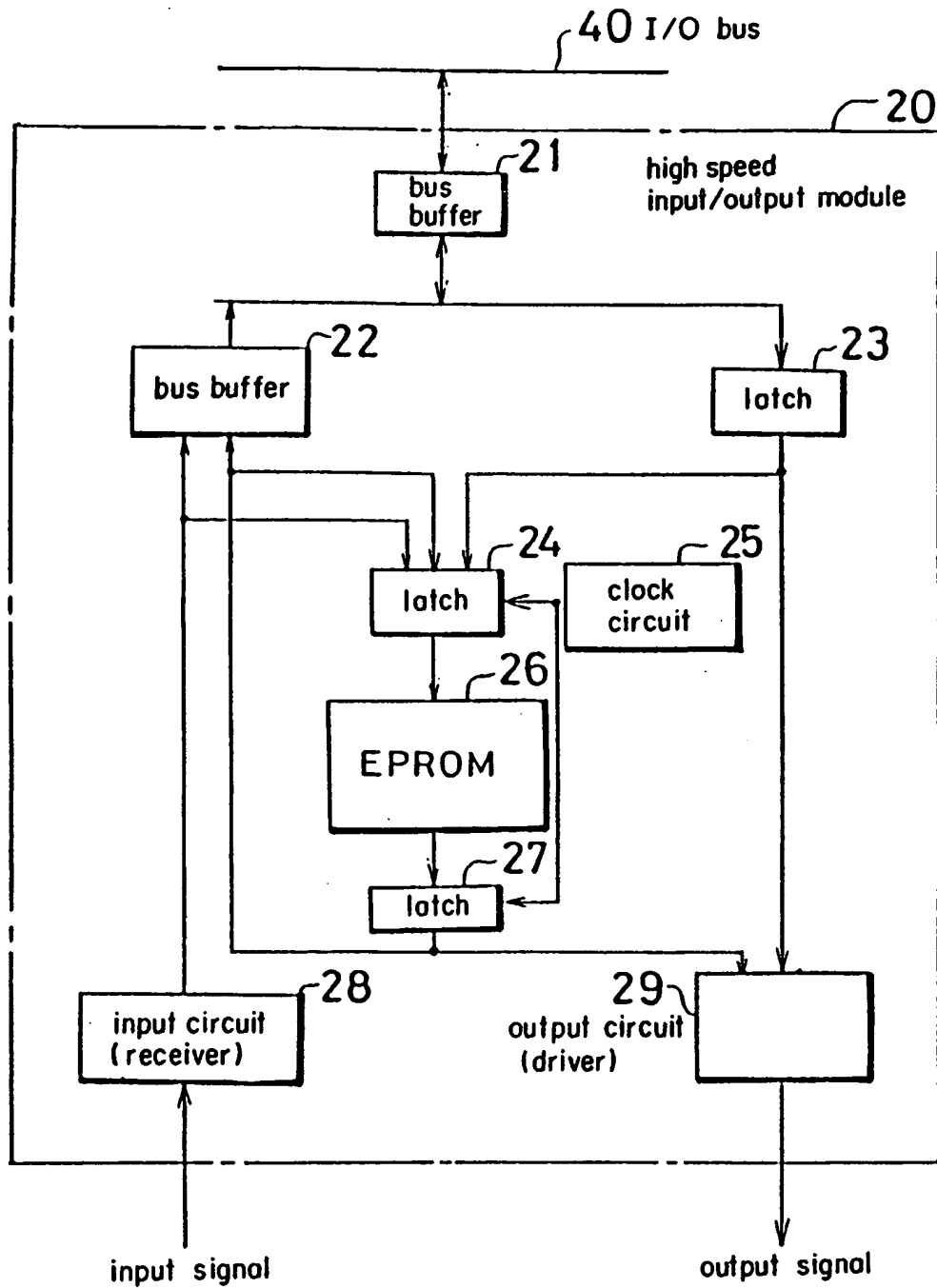


Fig. 2